

## **C5.8.1 Railings**

### **C5.8.1.1 General**

#### **C5.8.1.1.1 Policy overview**

**Methods Memo No. 162: Bridge Railing Selection on Interstate and Primary Highways  
29 June 2007**

See C5.8.1.2.1.

#### **C5.8.1.1.2 Design information**

#### **C5.8.1.1.3 Definitions**

#### **C5.8.1.1.4 Abbreviations and notation**

#### **C5.8.1.1.5 References**

### **C5.8.1.2 Permanent railings**

#### **C5.8.1.2.1 Traffic railings**

**Methods Memo No. 162: Bridge Railing Selection on Interstate and Primary Highways  
29 June 2007 (Revised 11 June 2009 to replace flow chart in Attachment A.)**

A new policy for determining Test Levels (TL) and the associated heights for railings on interstate and primary road bridges was approved by the Highway Division Management Team. This policy is intended to be a supplement to the current AASHTO LRFD Bridge Design Specifications, Section 13: Railings. See Attachment A for additional information.

The new policy states the following:

- All interstate mainline bridges shall require a TL-5 (minimum height of 44": 42" plus 2" for future overlay) railing.
- Bridge railing test level and the associated height for other primary highways shall be evaluated by Pre-Design Section (Field Exam) for replacement structures and the Preliminary Bridge Section for other bridges.

This policy is applicable to new bridges, bridge replacements, deck replacements and bridge widening and is effective immediately.

Bridge repair or rehabilitation projects where the existing railing is not affected by such work will not be required to comply with this policy and no retrofit is needed. If you have any question, please check with Ahmad Abu-Hawash for additional information.

### Guidelines for selection of railing for primary and interstate bridges

Generally, TL-4 (minimum height of 34": 32" plus 2" for future overlay) is considered acceptable for most interstate and primary roads with a mixture of trucks and heavy vehicles. But in some cases, other factors may require the use of TL-5 (minimum height of 44": 42" plus 2" for future overlay). These factors may include:

- Traffic volume and mix: The presence of high number of a van-type tractor-trailer as determined from predicted traffic data for the design year.
- Unfavorable site conditions where a rollover or penetration beyond the railing could result in severe consequences. This applies to bridges with fracture critical elements within the zone of intrusion or flyover bridges. Unfavorable site conditions includes:
  - Reduced radius of curvature
  - Steep down grades on curvature
  - Variable cross slopesExamples of fracture critical elements may include cables on cable stayed bridges, hangers on arch bridges, and truss members on truss bridges or supports for sign structures.
- Approach roadway rail height
- Headlight glare
- Snow pile up during snow removal spilling over roadways below
- Snow pile up causing ramping up the barrier rail

The need for TL-6 (minimum height of 92") railing which is suitable for higher level of protection is not anticipated for the vast majority of bridges in Iowa.

A flow chart (**Figure 1 was revised on 5 May 2009 to include bridges over BNSF and UP Railroads.**) has been developed to aid in the determination of the appropriate test level. The appropriate test level/rail height will need to be determined by the Pre-Design Section (Office of Design) in the early phase of project conception with input from the Districts during concept field exam. On projects that are not initiated in the Pre-Design Section, the determination of the test level will be the responsibility of the Preliminary Bridge Section (Office of Bridges and Structures). This effort will require some coordination among the various Engineering Bureau offices and the Districts.

Based on examining the factors discussed above and the predicted truck traffic for 2035 (see Figure 2), all mainline interstate bridges except as noted below would qualify for TL-5 railing with a height of 44". Rail height on mainline bridges near on-ramps need to be investigated for potential conflict with sight distance. Bridges on other highways in Iowa, overhead bridges and ramp bridges would require a similar evaluation using the attached flow chart. Overhead bridges near interchanges, especially in urban areas near side roads/streets, will require close evaluation of the available sight distance to avoid potential conflict.

The evaluation criteria discussed in this memo applies to both the median and outside railings and in some cases may results in different railing heights on the same bridge. Other considerations such as aesthetics may influence the decision on whether same railing height would be used for both the median and outside railings. Cost is a minor contributor based on comparing concrete volumes between the 34" and 44" rails. The 44" rail requires an additional 0.023 cu. yd. of concrete per lineal foot.

This policy is applicable to new bridges, bridge replacements, deck replacements and bridge widening. Bridge repair or rehabilitation projects where the existing railing is not affected by such work will not be required to comply with this policy and no retrofit is needed.

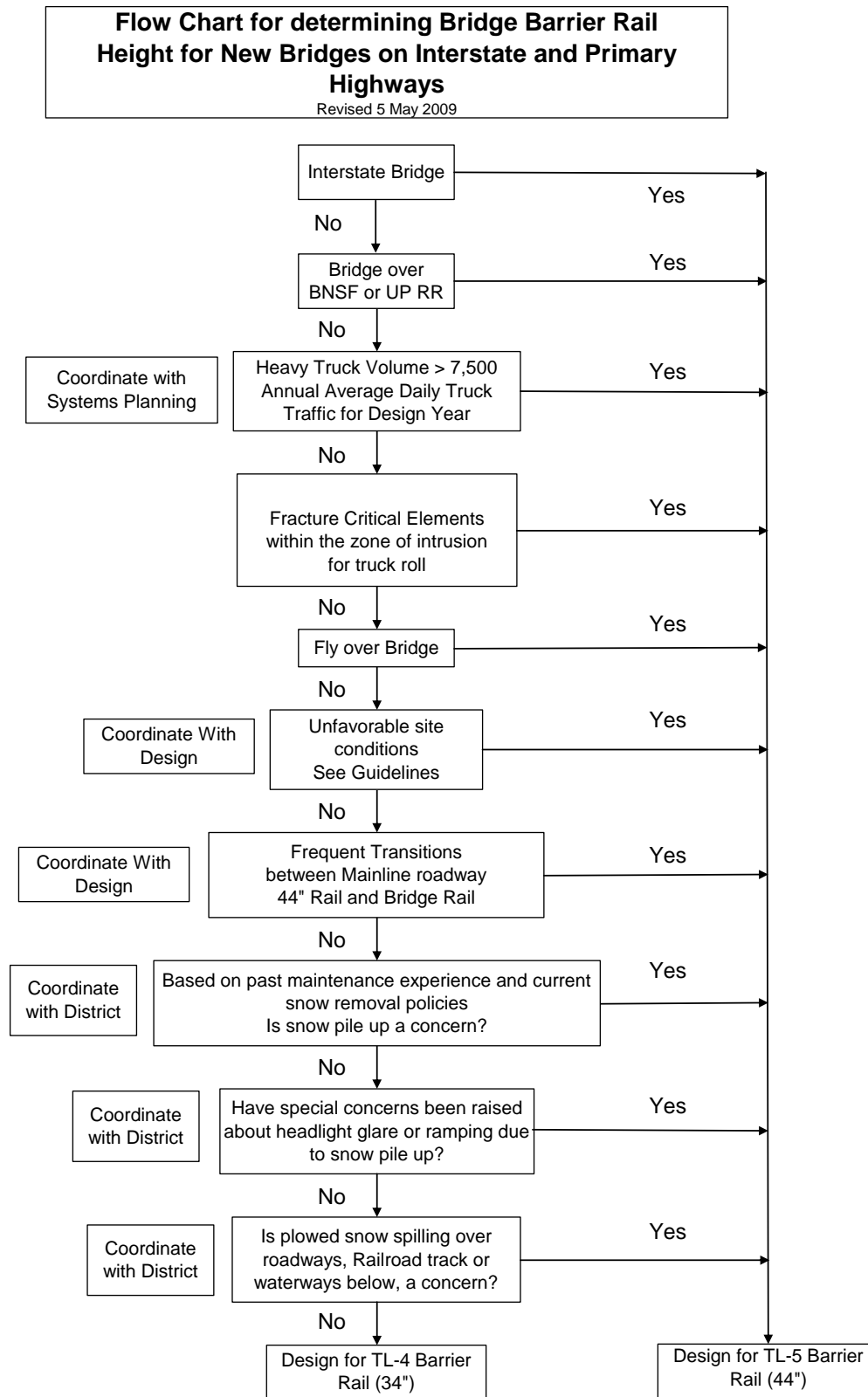
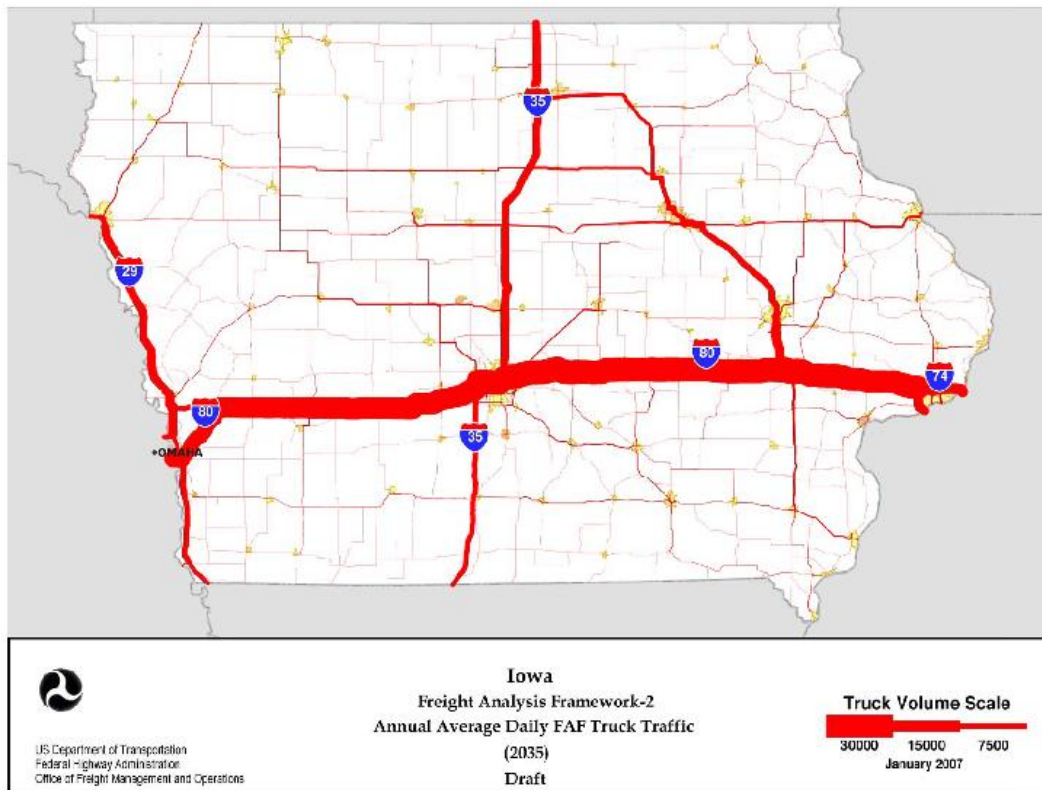
**FIGURE 1**

FIGURE 2



### C5.8.1.2.1.1 F-shape

#### Methods Memo No. 163: Revision MM No. 17 Lighting on Bridges 1 October 2007

Methods Memo No. 17 (Lighting on Bridges) has been revised as shown:

The current policy for lighting on bridges has been for the design engineer to evaluate whether the bridge is located near an urban area. For these projects determined to be in an urban area, the Engineer shall make a request (send a copy of the TS&L) to the Office of Traffic and Safety to determine the lighting and conduit requirements. Traffic and Safety, determines the conduit size, locates the conduit and light pole bases (if needed) on a TS&L sheet for the bridges submitted and returns the information back to our office. This policy has been revised as follows

Conduit will be provided in at least one rail on all bridges in accordance with the Design Manual (Road), Chapter 11B-3, "Lighting Information for Bridge Design". If the bridge is near an urban area or interchange, then the bridge may require light pole blisters. In this case the TS&L should be submitted to the Traffic Engineering section of the Office of Traffic and Safety for review. Traffic and Safety will review the site to determine if existing lighting is present or if a lighting project is planned in the near future. If it is determined that continuous lighting will be present at this location, light pole blisters and possibly underdeck lighting will be located and noted on a TS&L sheet and returned to the Engineer.

Where possible, light pole blisters should be centered above substructure elements. Consult the Office of Traffic and Safety regarding adjustments of light locations to coincide with pier centerlines. Junction boxes

will be placed at both ends of a bridge as a minimum. Additional junction boxes may be required to keep the maximum distance between them less than 500 feet. The maximum junction box spacing depends on the equipment used by the contractor. Most contractors can handle pulls under 500 feet and some contractors can handle pulls of 1000 feet and more. Conduits should be placed to line up with the junction boxes provided when possible to limit the number of bends required in the conduit. The sum of the conduit bends between junction boxes shall not be more than 360 degrees as specified in the “National Electric Code”.

~~This change in policy will require, as a minimum, that conduit be provided in at least one rail on all bridges.~~ In discussions with our lighting crews, it was found that conduit could be cleaned out and used even if the bridges have been in service for a number of years. CADD standard 1030A, 2 of 2, “Rigid Steel Conduit and Junction Box Details” has been added to the standard directory and 1030A 1 of 2, “Lighting” has been updated.

~~Metric standards have not been released at this time, but the English standards can be used as a guide until the metric standards are available.~~

**Methods Memo No. 207: Policy for Use of Steel Cover Plates for Concrete Barrier Rail Expansion Joint Openings and Limits on Conduit Size and Number in Concrete Barrier Rails (Article 5.8.1 Railings)**

**1 January 2009**

See 5.8.1.2.6.

**Methods Memo No. 25: Sight Distances on Bridges**

**10 September 2001**

There have been some problems with sight distances on bridges with pedestrian railing, chain link fence or tall barrier rails. These cases have been where there are ramps or approaches near the bridge where the railing or barrier has limited the sight distance for the motorist attempting to turn on to the highway. When working with similar site conditions the designer should be aware of any sight distance problems and check with Office of Design to make sure there will be no problems due to the rail or fence.

If you have any questions please check with your section leader.

**C5.8.1.2.1.2 Open**

**Methods Memo No. 207: Policy for Use of Steel Cover Plates for Concrete Barrier Rail Expansion Joint Openings and Limits on Conduit Size and Number in Concrete Barrier Rails (Article 5.8.1 Railings)**

**1 January 2009**

See 5.8.1.2.6.

**C5.8.1.2.1.3 Retrofit**

**C5.8.1.2.2 Pedestrian railings**

**C5.8.1.2.3 Bicycle railings**

**C5.8.1.2.4 Separation railings**

**C5.8.1.2.5 Aesthetic and special railings**

**Methods Memo No. 163: Revision MM No. 17 Lighting on Bridges**  
**1 October 2007**

See C5.8.1.2.1.1.

**Methods Memo No. 207: Policy for Use of Steel Cover Plates for Concrete Barrier Rail Expansion Joint Openings and Limits on Conduit Size and Number in Concrete Barrier Rails (Article 5.8.1 Railings)**  
**1 January 2009**

See 5.8.1.2.6.

### **C5.8.1.2.6 Concrete railings**

**Methods Memo No. 150: Revision to CADD Note E188/M188**  
**9 March 2006 (Supersedes Methods Memo No. 110, which has been placed in the appendix to this commentary section)**

See C11.3.2.

**Methods Memo No. 207: Policy for Use of Steel Cover Plates for Concrete Barrier Rail Expansion Joint Openings and Limits on Conduit Size and Number in Concrete Barrier Rails (Article 5.8.1 Railings)**  
**1 January 2009**

Steel cover plates for concrete barrier rails

A question was brought up on the office's guidelines for expansion joint openings for concrete barrier rails and when cover plates should be used to protect the openings. Therefore, the following guidelines have been adopted for concrete barrier expansion openings and should be followed on both new bridge projects and rail retrofits repairs.

When the maximum expansion joint opening in a concrete barrier rail is 4 inches or greater:

1. The entire barrier rail joint opening (front and back) shall be covered by a minimum 3/8 inch galvanized steel plate that shall extend a minimum of 9 inches past the expansion opening. Larger plate thicknesses should be considered for openings over 6 inches.
2. The plate shall be fabricated to conform to the front face of the barrier including the top. In addition, a separate back plate shall be used that meets the front plate at the top of the barrier rail.
3. The joint where the 2 plates meet shall be sealed with light gray non-sag latex caulking sealer marketed for outdoor use.
4. The exterior face of the plates shall be recessed a 1/4 inch below the surface of the rail to reduce snagging potential.
5. The cover plate will allow for the full thermal movements required at that joint location plus any setting factors that are required for the joint.
6. This policy does not apply to open rails.

Limits for conduit size and number in concrete barrier rails

In addition, a question was brought up on the office guidelines for conduits in F-shaped barrier rails and the number and size that can be used in a single barrier rail. There is a safety concern with the casting of large conduit or multiple smaller sizes in our concrete barrier rails. Therefore, the office's policy will be to limit conduit size and diameter to a maximum of two (2) rigid steel conduits per rail. The rigid steel conduit sizes shall be limited to 2 - 2 inch (ID) diameter or 1 - 2 inch (ID) and 1 - 3 inch (ID) diameter. These limits apply to all concrete barrier rails including open rails and rail retrofits.

These new policies shall be used on both new bridge projects and rail retrofits. If you have any question please check with me.

### **C5.8.1.3 Temporary barrier railings**

#### **C5.8.1.3.1 Concrete**

#### **C5.8.1.3.2 Steel**

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## **Appendix for obsolete and superseded memos**

### **Methods Memo No. 110: Concrete Placement of Concrete Barrier Rail 26 January 2005 (Superseded by Methods Memo No. 150 in C11.3.2)**

Currently the majority of concrete bridge rail is placed using a slipforming operation. The specifications require the use of a “BR” concrete mix design (Article 2513.03B1-5) for cast-in-place and slipform concrete barrier rail. It also allows substitution of a Class D concrete in lieu of the “BR” mix design when the Class BR concrete mix is not available. Based on some quality issues associated with the slipforming operation the bridge office in conjunction with the Office of Materials and the Office of Construction proposes to have bridge plans specify the intent to use the “BR” concrete mix if slipforming of the concrete barrier rail is the selected placement option by the Contractor. In addition, the use of Class D concrete will still be allowed when placing concrete barrier rail, however the cast-in-place method (fixed forms) will be required in lieu of slipforming.

To accomplish this action, bridge plans will include the following information:

- 1.) In the General Notes place the following:  
“Concrete barrier rails placed using the slipform method will require the use of a Class BR concrete in accordance with Article 2513.03B of the Standard Specification. Class D concrete is not permitted for concrete barrier rails placed using the slipform method.
- 2.) In the bid item reference information add the following:  
“If placement of concrete is done by the slipforming method, Class BR concrete is required. When Class D concrete is used for concrete barrier rails, the cast-in-place (fixed form) method of placement will be required. Price bid for this item shall include the cost of cast-in-place forms if required for placement of the concrete.”

This process will be effective starting with the May 2005 letting. Incorporate the above notes into appropriate bridge plans.